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DRIESCH'S THEORY OF VITALISM.

THE three books by Professor Hans Driesch here under discussion[1] (with which there might be included both many papers and some earlier volumes), although they differ somewhat as to their content and the order and method of presentation, as the author's opinions have developed and he has desired to reach different classes of readers, are all written from a very definite standpoint with reference to a very particular problem. This may be stated simply: What is it which distinguishes organic phenomena from inorganic? And the answer thereto, defended from many sides, drawn from many sources, is a new, distinctive, and, in its methodological defence, interesting theory of vitalism. Accordingly, I have selected as the purpose of this discussion the digest of these distinctive features, the exposure of this central idea, and the critical examination of the support and proofs advanced, rather than the systematic outline of each volume.

The fundamental questions raised are stated, *e. g.*, in *Vitalismus*, p. 171[2]: "Are there, among the events which take place in living beings, those which cannot be reduced (*zurückgeführt*) to otherwise known natural phenomena or to combinations of these, but which are a law unto themselves and autonomous?" "And to what degree and extent does this autonomy exist, what does it mean, and what follows from it?"

In answering these, the author's methods are those, first, of purely biological experimentation and analysis (in the volumes *S* and *V*), and, secondly, of unification with, through the analysis and interpretation of, the principles and results of chemistry and physics (in volume *N*). He thus seems to believe that he has two rather distinct and independent foundations for his position. By the first, — and to anticipate his conclusion somewhat, — he is, in his opinion, led to the 'entelechy' as a 'Naturkonstant' in a manner wholly descriptive and without hypothesis and yet with as great cogency as, for example, were Pfeffer and Van 't Hoff to osmotic as a new kind of energy.

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[1] *Die Seele als elementarer Naturfaktor: Studien über die Bewegungen der Organismen*, Leipzig, W. Engelmann, 1903. — pp. vi, 97. *Naturbegriffe und Natururteile: Analytische Untersuchungen zur reinen und empirischen Naturwissenschaft*, Leipzig, W. Engelmann, 1904. — pp. viii, 239. *Der Vitalismus als Geschichte und als Lehre*, Leipzig, J. A. Barth, 1905. — pp. x, 246.

[2] In this discussion I shall designate references to the first of these volumes by *S*, to the second, by *N*, to the third, by *V*.

In his presentation of this, given in a more or less extended manner in each volume, five subordinate proofs are offered. The first, and for the author the most important, consists in certain phenomena which result from experimentation on developing organisms. To take an illustrative case: If the division-cells of the developing sea-urchin egg in the two- or the four- or up to the thirty-two-cell stage are separated from each other, each will develop into a small, though complete organism (*V*, pp. 185–199); or if the 'gastrula' of this and other echinoderm eggs is cut at right angles to its long axis, and with certain limits, then each part continues to develop and forms a typical, normal, though smaller animal. Or, again, a case typifying a great mass of genuine 'restitutions,' the hydroid-polyp, *Tubularia*, consisting of stem and head, forms, when its head is cut off, a new head; let the cut be made in various ways, then the remaining, yet in each instance differing, parts of the stem coöperate to form the different parts of a complete and perfect head.

The significance of the phenomona typified by these cases lies, he concludes, in this characteristic, common to them all, that freely chosen parts of a whole can produce a new whole, by means, *e. g.*, of each cell of the part remaining after the operation 'taking over,' in coöperation with other cells, the formation of a very definite part of the new whole. Accordingly, the rôle played by each such 'element' varies with that played by the others in the formation of the whole, which rôle, also, would be different in the case of the uninjured than of the 'operated' organism. A system of such elements, because of their varying yet coöperative functions, is called an 'harmonisch äquipotentielles System,' and each 'element' has a varying 'prospecpective Bedeutung.'

There are other proofs, but since it is this first one that the author emphasizes most, we may consider its formulation. Yet before doing this, and by way of criticism, it may be remarked that there has been a great deal of work done very recently in this embryological experimentation, *e. g.*, by Wilson, Conklin, and others, and that by no means all of this is wholly confirmatory of Driesch's own work.

The formulation is as follows (*N*, pp. 120–122). That which an element, cell, or 'crosscuts' does or becomes, *i. e.*, its 'prospective Bedeutung' is a function, (1) of its position, *a*, (2) of the absolute size of the system, *g* (for, as this decreases, say, from an operation, so is the size of the developed whole diminished), (3) of a constant quantity, namely, of the 'Spezifität' of that which can develop within the limits of this species, and which brings it about that all parts coöperate to produce the normal; this quantity is *e*. Therefore the 'prospective Bedeutung' is $S = \int (age)$.

Of what sort, now, is *e*? Is it the result of external factors? No! For these have no effect on the differentiation, which remains within the frame of the species. *E* would, therefore, seem to be something internal, namely, the physico-chemical structure, something machine-like in the 'broad sense' of this term. But against this the author argues that, when the organism is successively divided and certain final elements, *i. e.*, cells, etc., are reached, these do not possess an invariable 'prospective Bedeutung,' as would be the case with the parts of a machine. On the contrary, experiment shows for him that each part is a whole, and, as it were, an infinitely complex machine.

Now, in criticism of this, it may be said, first, that the author has juggled with the term 'machine,' using it first in a broad, and then in a narrower and even technical sense. Manifestly that which holds good of the second is not necessarily true of the first meaning. And, secondly, and contrary to what he would have his analysis imply, it would be admitted, even generally, that each element of a chemical-physical manifold can and does play a variable rôle, namely, so far as, and in the sense that, it enters into different complexes, but, therefore, also in a way which is quite compatible with invariability. Our author's conclusion, however, is that *e* is a new 'Naturfaktor,' one *sui generis*, to be called entelechy,[1] and demonstrated by the method of elimination.

With the other proofs we need not concern ourselves at length. Suffice it to say that, on the basis of an analysis and classification of behavior, *i. e.*, organic movements, instincts, reflexes, etc. (*V*, pp. 208–216), an analysis, too, that is oftentimes meagre, the author finds that the organism is not a machine, and that that which determines the specific nature of this behavior in each case is an entelechy, which in some instances may be a 'psychoid.' Therewith is implied not only his acceptance of different kinds of entelchies, but also, since their activity as 'Naturfaktoren' is a directly participating one, his opposition to parallelism.

This completes the author's proof for his position regarding what might be termed 'the empirical laws of the organism' by means of experimentation and the analysis of its results. There remains what he regards as additional and supplementary proof drawn from an analysis of the principles and results of physico-chemical science. For he feels that it is incumbent upon him not only to show that the function of the entelechy is in thorough-going harmony with these principles, but also to demonstrate, by a sort of 'method of residues,' both the necessity of accepting such a cause, and the specific nature of its functioning. This is done in Volume *N* at length, in Volume *V* in epitome.

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[1] The presentation of the further details of the author's position will make it clear that the term 'entelechy' is used by him in a sense differing somewhat from the Aristotelian.

In this analysis the author appears as, in general, an adherent of the school of energetics of Ostwald, Helm, Wald, and others, and oftentimes his criticisms and elucidations are both clear and valuable, though frequently he finds no opportunity to apply them to his particular problem. He distinguishes four fundamental principles or laws: those, namely, of conservation, division into potential and extensity factors, entropy, and *Eindeutigkeit;* and it is important for the understanding and weighing of his arguments to notice that he explicitly accepts, of course in the sense of their meaning as he expounds it, their validity for the organism. (*V*, p. 231.)

Energy is not substance, but only the quantitative measure for causality. The first law, that of conservation, is in part *a priori*, *i. e.*, necessary for thought; it is empirical in respect to the 'things' for which it holds. So, likewise, the second law has an *a priori* aspect; there must be differences in order that something may happen; empirical science finds what these differences are, namely, that in the differences of intensities rests the condition for events. According to the third law every change must 'go out' from the highest intensity. Equilibrium exists when one potential compensates another opposed intensity. Disturb this, *i. e.*, create an 'uncompensated potential difference,' — this to be done only by the doing of work, — and 'something happens,' until equilibrium is again reached. From the first three laws the fourth is derived, at least in part, namely, that events are in a definite direction, unequivocal, and invariable.

In approaching his special problem, our author now states that "all events, etc., in the biological field are concretely the changes in the chemical and aggregative characters of matter." By aggregative is meant simply liquid, solid, colloidal, and such physical states. These characters, therefore, concern him especially, and his criticism, etc. here is also interesting and oftentimes well taken, though his position as to certain problems would not meet with universal acceptance. That which is most essential to his argument, and which is, further-more, as I believe, that I can show, an erroneous interpretation, is his position that, *e. g.*, the 'chemical Energetik' has, in picking out the quantitative side, therewith excluded the peculiarly and distinguishingly chemical qualitative side; and that this latter, in the reactions and compensations involved, belongs wholly to the empirical field. It is of this principle that he makes use in his subsequent arguments as to the nature and implications of the peculiar qualitative side of the organism. This is defined (*N*, p. 163) as an 'heterogeneous complex' body, *i. e.*, one consisting of parts varying in number, and also as 'typisch,' because the specific and differentiating characters are repeated in many individuals and generations according to some kind of rule or law. The peculiar character of this 'Zusammensetzung' is, indeed, the center for his attention at this point; it gives a whole which as a whole is 'gesetzlich.' Briefly put, he argues: (1) the organism is composed of parts, chemical and aggregative or physical; (2) these follow inorganic laws, quantitative and qualitative, 'denknotwendig' and empirical, thus including, of course, the four fundamental laws; (3) but the whole as such has certain qualities which the parts have not; (4) these qualities are not to be derived additively from those of the parts.

Now all of this can be agreed to without hesitancy by the non-vitalist, the thorough-going mechanist. Such a 'creative synthesis,'— as this 'bringing about' by the parts of qualities of the whole which the parts have not may be called, — holds good of every chemical and aggregative compound. Therefore, in regard to this crucial point of his position, only the details of which receive his subsequent attention, it may be said that our author, in finding in the specific qualities of the organism as a whole those which no other complex has, and in seeing in this a basis for distinguishing the organic from the inorganic and for accepting an entelechy, is making a difference which does not make a real difference. It is, of course, a fact that every chemical compound, every complex of such compounds, is specifically different from every other compound and complex, and it may also be that each 'element' or part functions differently in different complexes, — which is a variability quite compatible with invariability under the same conditions. All this holds good of colloidal solutions, which protoplasms are. But through such a line of argumentation no theory of entelechies, of vitalism, of a fundamental difference between the living and the non-living, can be established. Either no phenomena are distinguishingly vitalistic, or the whole chemical and aggregative series is as much so as is the organic. Any difference thus made is only one of terms.

However, the author makes a quite different use both of 'creative synthesis' and of the specific character of each complex. For him the organism is a chemical-aggregative complex; the energy laws, he admits, are valid for both the whole and the parts, but include only the *quantitative* side, yet in a way, of course, not contradictory with the qualitative. As a result (?) of the creative synthesis, there is a 'wholeness' specifically different from the 'wholeness' of any other complex. This 'wholeness' is 'gesetzlich,' its laws being discovered empirically by such methods as he has previously emphasized. Now to account for such a 'wholeness,' — an effect, as he regards it, — there must be a cause, an agent. Thus he gets to the entelechy as a 'Naturfaktor.' To quote (*N*, p. 167), "all events in the organism can be regarded as, in the end, chemical changes"; "it is out of these that there result the regenerations, movements, etc." But it is to be emphasized that, with these taken as a whole, "there takes place something in accordance with a law according to which nothing in the inorganic realm happens, and for such a 'differential' change there must be a 'differential' cause."

Whence, now, comes the entelechy, or has it no origin? Here, I think, the author gets into a serious dilemma. It would seem that, if in the organism we have a chemical aggregative complex, the entelechy must be either (1) the *additive* result of the parts, or (2) something 'synthetically creative,' or, if neither of these, then (3) a new constant, free and independent, either previously existing or appearing quite 'out of nothing.' But here he vacillates. He rejects the first possibility, but accepts either implicitly or explicitly sometimes the second, at other times the third. For example (*N*, p. 186), he says: "Just as in each specific chemical aggregative fact something new is added, so here (in the organism) something new and specific is added to the totality (*Gesammtheit*) of the parts;" while again, taking the third position, he says (p. 195): "It is wholly unallowable to regard the entelechy as the '*Resultante*,' even of a new kind, arising from the working together of inorganic factors." Whether the entelechy then has previously existed as an entity or has appeared 'from non-being into being' is not discussed at length, though it is recognized that the first possibility, especially in the form of 'entelechy present and yet not expressing itself,' means its conservation, and is a spiritistic position.

The third of the above positions is, in general, taken *implicitly* in the scheme by which the specific function of the entelechy is developed. And yet here, too, I think, the argument is full of inconsistencies.

Driesch grants, first (*N*, pp. 160–162), that the chemical and aggregative events of the organism are each '*determined*,' in their direction, etc., in accordance with the four laws which he has expounded. It would seem, then, that at the same time when the principle of 'creative synthesis' is working the parts, with their compensations, etc., would suffice to determine the direction of the organism as a whole. But not so. Having been led to what he regards as a fact, namely, that in the 'Aufeinanderwirken' of the parts in the whole a specific and not merely a chemical 'Gesetzlichkeit,' *i. e.*, an agent, is coöperating with the parts, he finds it necessary to make room for its functioning, and to limit the rôle which the uncompensated intensity-differences, etc., of these parts play. (*N*, pp. 176–188.) All the most valuable information as to what this rôle in any case may be, is, he states, of empirical origin. Therefore, *empirically only*, he argues, can this rôle be farther limited or widened; only empirically can it be found what specific intensities compensate specific intensities or disturb specific equilibria. Therefore, first, it is possible to show in general, and, second, experience *does* actually disclose it as a fact, that the entelechy has just this function of compensating otherwise uncompensated potential differences or of disturbing otherwise compensated differences.

Here, then, clearly, the Entelechy is regarded as a *new* compensating factor, different from and in addition to those of the parts. And here, too, appears the crucial question: Do or do not the parts with their compensations, etc., suffice for the understanding of 'vital autonomous events'? To this I should answer (while also seeing in this, from the pragmatic standpoint, a simpler and equally efficient scientific means of describing, explaining, and controlling), that the scheme of constituent parts, chemical and aggregative, with their intensities, compensated or not, bringing about by their 'creative synthesis' new qualities of the whole, not only *entirely* suffices to account for all the compensations, 'directings,' etc., which experiments may bring to light in the organism as a whole, but also that therewith an invariability of events is guaranteed and any other compensating factor made superfluous.

But the author does not agree with this conclusion, though certain of his previous statements would allow of his so doing. Such a scheme, he holds, is *not sufficient* (*N*, pp. 176–188) to account especially for the 'Endziel,' for the 'persistence in the normal' under varying conditions. The entelechy has been set up as the 'differential' cause for a 'differential' effect, namely, for the qualities of the whole as over against those of the parts. 'Creative synthesis' being rejected or overlooked, and therewith the first false step made, the second follows: The entelechy is held to compensate where, however, all compensation is already provided for, namely, in the parts. And then comes the third: If the entelechy compensates, it would seem, first, that it must be the intensity factor of a new, say vital, energy, and, secondly, to be derivable, according to the usual principle of transformation, from other energies. These last conclusions, however, the author denies explicitly (*N*, pp. 188–196): he gives up or finds no advantage in speaking of 'vital energy,' and has stated that the entelechy could not be a 'result.' Here, then, were the entelechy to be granted even as an 'intensity,' it would be without its correlative extensity factor and, consequently, different from other intensities. Might not the difference extend as far as to its not being able to compensate after all? In fact, the author himself seems to feel instinctively some such difficulties. His first false steps have now become a running gait (*N*, pp. 190–199). For he says that the entelechy has the function of 'linking' the 'Energiegetriebe'; it is a cause but not energy; it 'correlates' in the sense of 'being necessary' but not causal (*N*, p. 206); its function is an 'act' but not a 'Geschehensfolge.' Put briefly, my criticism is, that its 'compensating' function cannot be worked out in a manner consistent with the principles of compensation, etc., previously laid down. It finally appears emasculated to the extent that its quondam function (?) has volatilized entirely; everything is already provided for.

The origin of this series of errors, as I regard them, lies, however, in a more fundamental error in his methodological analysis of the four laws. These he has interpreted as purely quantitative and as, therefore, saying nothing about, though compatible with, the qualitative side of phenomena, this remaining for empirical investigation. That this last is always necessary and that it cannot be replaced, I am quite ready to admit. But, even granted that the qualitative side is to be obtained by the empirical method alone, that which the four laws say and mean is, not simply that there is no contradiction between them and the empirical qualitative laws, but that every quality is at the same time also quantitative, and in this case quantitative in the manner expressed by the four laws. It may or may not be conceivable that there should be a quality which would not also be quantitative, *e. g.*, as an intensity, but this does not concern us here.

But to start with the four laws, and in an interpretation of them at once arbitrary and apparently incorrect (since it does 'not touch' the qualitative side) to find the grounds for a new factor called 'entelechy,' to try to discover its functions, and finally to find these compatible with, because 'not touched' by, these quantitative laws, is to argue in a circle or worse. However, with one such case before us, perhaps it ought not to be surprising, too, that the author should discover no incompatibility between his admission on the one hand (*N*, Part I) that the operation of the four energy laws in general, and, therefore, by implication, in the chemical-aggregative parts of the organism in particular, should constitute an invariability of events, and, his view, on the other hand, that the function of the entelechy is a 'choosing, regulative one' (*N*, p. 205) whereby it is brought about that the organism, either in whole or in part (acting as a whole), makes for some end. Here, to be sure, there is another possibility, namely, that, given any energy-complex, each energy-form can be regarded as making for some end (*i. e.*, effect) different from what would 'be made for' without it, and were the entelechy actually established as a compensating factor, etc., it could well play this rôle, which is quite compatible with invariability and determinism.

But it is quite clear that our author does not mean this. Both in connection with his 'experimental embryology' and here he has in mind an actual variability, namely, that of 'the same end under different conditions.' To be sure, he need not make this interpretation of his experimental results, as I have previously pointed out, but as a matter of fact he does make it, and it is this which is inconsistent with the invariability' implied in his other statements. His teleology, therefore (for that, of course, is what his introduction of the *entelechy* means), need not concern us long. A 'statical teleology,' which he defines as 'a dependence on a specific order of specific parts and as an inversion of cause and effect', he rejects. Rather, his is a 'dynamic teleology,' for which there is an independence of this order, and a predominance of unity and wholeness. To effect this is the work of the entelechy, which is at least a 'Primärwissen and -wollen,' at the same time that, by previous definition, it is a compensating factor. Even granted the Entelechy, then, it would seem, either that this 'compensating' must be like that of other energies, with the result that the 'Primärwissen and -wollen' are superfluous, and there is no more opportunity for variability with than without them, or that it is different, so that, with the compensations of the constituent parts sufficing, its rôle is an entirely empty one.

In conclusion, therefore, it may be said that, although the volumes before us contain a great deal that is suggestive, interesting, and valuable, nevertheless the author has not established his case. He has created illegitimately a 'Naturkonstant,' for which he fails to find a rôle that cannot be played by the 'constants' already at hand, and which also contradicts his own statements about the rôle of these 'constants.' The four energy-laws, *plus* the 'empirical' ones of the qualities both of the parts and of the whole, those, namely, which result from the 'synthetic creation' of the parts, with the recognition that both these sets, at the same time that they are qualitative, are also quantitative, account for the specific characteristics of the organism as a chemical aggregative complex as well as for every other such complex, and, of course, imply an invariability, a definiteness of direction, etc., in the events of such a complex. The difference is simply an empirical and specific one as between complexes, and there is no other difference between the organic and the inorganic; *i. e.*, it can be said and said truly, without embracing a vitalism of any kind, that the organism is a complex whose parts are to be found together nowhere else, and as a whole it possesses qualities which cannot be exactly duplicated elsewhere. Since there is as much or as little necessity, therefore, for an entelechy in the inorganic as in the organic, it is, if accepted, superfluous and functionless, a made difference which does not make a difference.

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